IAFF 6501- 11
Applied Quantitative Analysis

Class 4

More on Standard Deviation, Z-scores, & Sampling Error

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Review of Standard Deviation (*s*)

- *Standard deviation* = the average variability in the set of scores in the same units as the scores
- Formula: $s = \sqrt{\Sigma(\text{X-mean})^2/\text{n-1}}$

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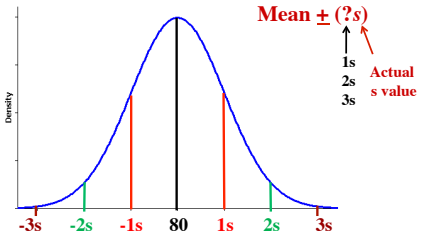
SD Units



Practice

– Mean =100, *s*= 15

- *What individual score falls 1 standard deviation above the mean?*

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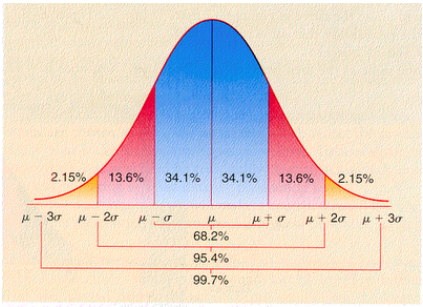
Percentages of Cases in Each SD Unit on the Normal Curve



Z-scores

- A standardized score

$$Z = \frac{X - \mu}{\sigma}$$

- This tells us how many standard deviations from the mean the score is.
- Other ways to say that:
  - Z score represents the relative standing of each observation (X) to the mean in σ units.
  - X is Z units above/below mean.

The Normal Distribution & Z scores

- Healthcare worker annual salary
  - μ= $20,000; σ= $1,500
  - Individual with annual income = $22,000
  - What is the z-score? $Z = \frac{X - \mu}{\sigma}$

The Normal Distribution & Z scores

- Table A on page 512
  - For a z-score of 1 (a score 1 σ above the mean):
    - What percent of scores are between that and the mean?
    - What percent of scores fall above that?
    - What percent of scores fall below that?

Practice

- Healthcare worker annual salary example:
  - μ = $20,000; σ= $1,500
  - Individual with annual income = $22,000
  - What is the z-score? 1.33
  - *What percent of scores fall above that?*

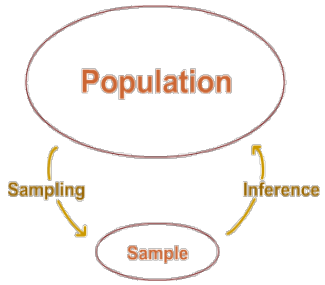
Finding X from Probability on Normal Curve

- Modify our Z - score formula:

  $X = \mu + z\sigma$

- Steps:
  - Locate in Table A the z-score that cuts off the area closet to the area under the cover
  - Convert the z value to its raw score equivalent
- Example
  - Find the salary for the top 10% of earners

Sample, Population, & Sampling



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Review: Statistics vs. Parameter

- Sample Statistics
  - $\bar{x}$ = sample mean
  - s or SD = sample standard deviation
  - s^2 = sample variance
- Population Parameters
  - μ = population mean
  - σ = population standard deviation
  - σ^2 = population variance

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Inferential Statistics

Inferential Statistics - draw inferences about a population (entire group) from data collected from a sample (subset of entire group)

compared to

Descriptive Statistics - organize & summarize a collection of data

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Sampling Error

- Difference between the value of a sample statistic (e.g. sample mean) and the true value of the population parameter (e.g. population mean)
- Example: Gallup Poll predicts candidate Smith will receive 56% of the votes ±4% margin of error.
  - Confident that Smith will receive between 52% - 60% of vote [56% - 4% = 52; 56%+ 4% = 60%]

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